

REMARKS

This Amendment is in response to the Office Action mailed on August 9, 2006. Claim 9 is amended and is supported, for example, in the specification on page 10, lines 21-24. No new matter is added. Claims 9-12 are pending.

§103(a) Rejections:

Claims 9-12 are rejected as being obvious over Kwon (US Publication No. 2002/0022301) in view of Chen (US Publication No. 2003/0013291). This rejection is traversed.

Claim 9 is directed to a method of manufacturing a semiconductor device that requires, among other features, the step of forming a pad layer to be a bonding pad on a surface of the intermediate layer and patterning the intermediate layer and the pad layer time after forming the pad layer by using a resist as a mask for patterning the pad layer and the pad layer as a mask for patterning the intermediate layer. By patterning the intermediate layer and the pad layer by using a resist as a mask for patterning the pad layer and the pad layer as a mask for patterning the intermediate layer, the process of manufacturing a semiconductor can be achieved more efficiently.

The combination of Kwon and Chen does not teach or suggest these features. In the present Office Action, the Examiner interprets Kwon to include a multi-layered UBM of which one layer is a bonding pad. However, claim 9 requires that the bonding pad is formed on the surface of the intermediate layer. Nowhere does Kwon teach or suggest that the upper most layer of the multi-layered UBM is a bonding pad layer. Moreover, even if the Examiner's interpretation of Kwon is accepted, nowhere does Kwon teach or suggest patterning the intermediate layer and the pad layer by using a resist as a mask for patterning the pad layer and the pad layer as a mask for patterning the intermediate layer.

Chen does not overcome these deficiencies. Chen is directed to a passivation and planarization process for flip chip packages. Nowhere does Chen teach or suggest the step of forming a pad layer to be a bonding pad on a surface of the intermediate layer and patterning the intermediate layer and the pad layer after forming the pad layer by using a resist as a mask for patterning the pad layer and the pad layer as a

mask for patterning the intermediate layer. Chen is relied on by the Examiner merely to teach the use of a BCB polymer resin for use as a passivation material.

Claim 9 also requires the step of forming a resin insulating film to cover edges of patterns of the bonding pad and the intermediate layer, including an outer interface thereof, after forming the bonding pad. The importance of forming a resin insulating film to cover edges of patterns of the bonding pad and the intermediate layer, including the outer interface thereof, after forming the bonding pad is to insure that no portion of the intermediate layer or the electrode pad is exposed to oxidation. If the insulating film is formed before forming the bonding pad two problems that the present invention is intended to solve can occur. First, if any portion of the bonding pad is formed over the insulating layer a short circuit may occur. Secondly, if care is taken to insure that no portion of the bonding pad is formed over the insulating layer a gap between the bonding pad and the insulating layer may form, thus exposing the intermediate layer or the electrode pad to oxidation (see page 2, line 1-page 3, line 7 and Figure 1).

The combination of Kwon and Chen does not teach or suggest these features. As discussed in Applicant's Amendment on May 14, 2006, Kwon explicitly shows in Figure 5 that the passivation layer (106) is formed onto the silicon wafer substrate (102) before the under barrier material "UBM" (108) is formed onto the chip pad (104). Figure 6 of Kwon then shows the UBM (108) formed in the opening of the passivation layer (106) and onto the chip pad (104). With this method it would be difficult for any portion of the passivation layer (106) to cover the outer interface of the UBM (108). As a result, the possibility of a gap forming between the passivation layer (106) and the UBM (108) increases that could result in the oxidation of the chip pad (104).

Chen does not overcome these deficiencies. As discussed above, Chen is relied on by the Examiner merely to teach the use of a BCB polymer resin for use as a passivation material. For at least these reasons, claim 9 is not obvious over the combination of Kwon and Chen. Claims 10-12 depend from claim 9 and are not unpatentable for at least the same reasons.

Conclusion:

Applicant respectfully asserts that claims 9-12 are now in condition for allowance. If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicant's primary attorney-of record, Douglas P. Mueller (Reg. No. 30,300), at (612) 455-3804.



Dated: January 31, 2007

Respectfully submitted,

HAMRE, SCHUMANN, MUELLER &
LARSON, P.C.
P.O. Box 2902-0902
Minneapolis, MN 55402-0902
(612) 455-3800

By: 

Douglas P. Mueller
Reg. No. 30,300
DPM/ahk